

Additional References with Titles

Chapter 2

- Cohn, D.B., Parazzoli, C.G., Beck, D.G., Mastrup, F.N.: Optical pumping of CO by a convective flow CO laser. *IEEE J. QE* **22**, 723 (1986)
- De Benedictis, S., Capitelli, M., Cramarossa, F., Gorse, C.: Vibrational relaxation of N₂-CO in N₂ post-discharges: Comparison between theoretical and experimental results. Proc. VIII Europhysics Study Conf. Atomic and Molecular Physics of Ionized Gases (ESCAMPIG), Greifswald, GDR 1986
- Dem'yanov, A.V., Dyatko, N.A., Kochetkov, I.V., Napartovic, A.P., Pal', A.F., Pichugin, V.V., Starostin, A.N.: Properties of a beam-driven discharge in an H₂-Ar mixture. *Sov. J. Plasma Phys.* **11**, 210 (1985)
- Il'ukhin, A.A., Lipatov, N.I., Mineev, A.D., Myshenkov, V.I., Pashinin, P.P., Prokhorov, A.M., Smirnov, V.V.: Excitation of gaseous nitrogen flow by discharge scanned in magnetic field. *J. Tech. Phys. Lett. (Russian)* **11**, 25 (1985)
- Mnatsakanyan, A.Kh., Naidis, G.V.: The vibrational-energy balance in a discharge in air. *High Temp. (USSR)* **23**, 506 (1985)
- Polak, L.S., Sergeev, P.A., Slovetskiy, D.I.: Formation of complex and atomic ions in nitrogen glow discharges, in Proc. 1st Annu. Int. Conf. Plasma Chemistry and Technology, ed. by H.V. Boenig (San Diego, Calif. 1982)
- Valyanskii, S.I., Vereshchagin, K.A., Vernke, V., Volkov, A.Yu., Pashinin, P.P., Smirnov, V.V., Fabelinskii, V.I., Chapovskii, P.L.: Studies of the kinetics of the vibrational and rotational distribution functions of nitrogen excited by a pulsed discharge. *Sov. J. Quantum Electron.* **14**, 1226 (1984)
- Vasil'ev, G.K., Makarov, E.F., Chernyshev, Yu.A., Yakushev, V.G.: Radiation-induced collisional pumping of molecules containing few atoms. *High Energy Chem. (USSR)* **19**, 295 (1985)

Chapter 7

- Allan, M.: Experimental observation of structures in the energy dependence of vibrational excitation in H₂ by electron impact in the $2\Sigma_u^+$ resonance region. *J. Phys. B* **18**, L451 (1985)
- Allan, M.: Excitation of vibrational levels up to $v=17$ in N₂ by electron impact in the 0-5 eV region. *J. Phys. B* **18**, 4511 (1985)
- Berman, M., Domcke, W.: Projection-operator calculations for shape resonances: A new method based on the many-body optical-potential approach. *Phys. Rev. A* **29**, 2485 (1984)
- Berman, M., Estrada, H., Cederbaum, L.S., Domcke, W.: Nuclear dynamics in resonant electron-molecule scattering beyond the local approximation: The 2.3 eV shape resonance in N₂. *Phys. Rev. A* **28**, 1363 (1983)
- Berman, M., Münderl, C., Domcke, W.: Projection-operator calculations for molecular shape resonances: The $2\Sigma_u^+$ resonance in electron-hydrogen scattering. *Phys. Rev. A* **31**, 641 (1985)
- Christophorou, L.G.: Temperature dependence of the isotope effect in dissociative attachment. *J. Chem. Phys.* **83**, 6219 (1985)

- DeRose, E., Gislason, E.A., Sabelli, N.H.: A new method for computing properties of negative ion resonances with application to $2\Sigma_u^+$ states of H_2^- . *J. Chem. Phys.* **82**, 4577 (1985)
- Domcke, W., Mündel, C.: Calculation of cross sections for vibrational excitation and dissociative attachment in HCl and DCl beyond the local-complex-potential approximation. *J. Phys. B* **18**, 4491 (1985)
- Gauyacq, J.P.: Dissociative attachment in e^- - H_2 collisions. *J. Phys. B* **18**, 1859 (1985)
- Hall, R.I., Andric, L.: Electron impact excitation of $H_2(D_2)$. Resonance phenomena associated with the $X\ 2\Sigma_u^+$ and $B\ 2\Sigma_g^+$ states of H_2^- in the 10 eV region. *J. Phys. B* **17**, 3815 (1984)
- Kazanskii, A.K., Fabrikant, I.I.: Scattering of slow electrons by molecules. *Sov. Phys.-Usp.* **27**, 607 (1984)
- Kazansky, A.K.: Vibrational excitation of molecules by electron impact via the virtual intermediate state. *J. Phys. B* **16**, 2427 (1983)
- Kazansky, A.K., Yelets, I.S.: The semiclassical approximation in the local theory of resonance inelastic interaction of slow electrons with molecules. *J. Phys. B* **17**, 4767 (1984)
- Mündel, C., Berman, M., Domcke, W.: Nuclear dynamics in resonant electron-molecule scattering beyond the local approximation: Vibrational excitation and dissociative attachment in H_2 and D_2 . *Phys. Rev. A* **32**, 181 (1985)
- Mündel, C., Domcke, W.: Nuclear dynamics in resonant electron-molecule scattering beyond the local approximation: model calculations on dissociative attachment and vibrational excitation. *J. Phys. B* **17**, 3593 (1984)
- Nishimura, H., Danjo, A., Sugahara, H.: Differential cross sections of electron scattering from molecular hydrogen. Elastic scattering and vibrational excitation. *J. Phys. Soc. Jpn.* **54**, 1757 (1985)
- Orient, O.J., Srivastava, S.K.: Cross sections for H^- and Cl^- production from HCl by dissociative electron attachment. *Phys. Rev. A* **32**, 2678 (1985)
- Salvini, S., Burke, P.G., Noble, C.J.: Electron scattering by polar molecules using the R-matrix method. *J. Phys. B* **17**, 2549 (1984)

Chapter 8

- Vakhterov, A.A., Il'ukhin, A.A., Konev, Yu.B., Lipatov, N.I., Pashinin, P.P., Prokhorov, A.M., Smirnov, V.V., Yurov, V.Yu.: Diagnostics of capillary discharge of a wave guide CO_2 laser using CARS techniques. *J. Tech. Phys. Lett. (Russian)* **11**, 3 (1985)
- Valyanskii, S.I., Vereshchagin, L.A., Volkov, A.Yu., Pashinin, P.P., Smirnov, V.V., Fabelinskii, V.I., Holr, L.: Determination of the rate constant for vibrational-vibrational exchange in nitrogen under biharmonic excitation conditions. *Sov. J. Quantum Electron.* **14**, 1229 (1984)

Chapter 9

- Akulintsev, V.M., Gorshunov, N.M., Neshchimenko, Yu.P., Shihanov, A.A.: Isotope separation in non equilibrium chemically reacting supersonic flow **29**, 918 (1984)
- Cacciatore, M., Billing, G.D.: Isotope separation by V-V pumping in CO. *Chem. Phys. Lett.* **121**, 99 (1985)
- McLaughlin, D.F., Christiansen, W.H.: Isotope separation and yield calculations for vibrationally enhanced oxidation of nitrogen. *J. Chem. Phys.* **84**, 2463 (1986)

Chapter 11

- Boeuf, J.P.: "Modelisation de la cinétique électronique dans un gaz faiblement ionisé"; Thèse d'état, Université de Paris Sud (1985)
- Loureiro, J., Ferreira, C.M.: Confled electron energy and vibrational distribution functions in stationary N_2 discharges. *J. Phys. D* **19**, 17 (1986)

Subject Index

- Absorption coefficient 236,237
- Adiabatic expansion 75,238,240
- Adiabatic factor 50
- Analytical theory of vibrational kinetics 47,52,54,56,302
- Anharmonic mixing 120
- Anharmonic vibrational states 271
- Arrhenius law 13
- Association 128
- Atom exchange 114,136,147,153
- Atom reactions with oxygen molecules 171,172

- Boltzmann distribution 11,51
- Born-Oppenheimer approximation 113

- Capture cross section 129
- Carbon monoxide dissociation in electrical discharge 33
- Classical survival factor 202
- CO and CO₂ lasers 235
- CO vibrational distribution 17,38,39,43,239,240,274,279,280,284
- CO₂-N₂-He discharges 244
- Coherent anti-Stokes Raman scattering 249
- Collision complexes 115,128,149,150,152,153
- Collisions between free radicals 150
- Collisions between free radicals and noble gas atoms 134
- Condon diffraction bands 210
- Coordinates for rearrangement processes 173
- Coriolis coupling 100,120,122

- Cross section for dissociative electron attachment 199,202
- Cross section for vibrational electron excitation 200,202

- Decoupling schemes for rotations
 - centrifugal sudden (CS) 175
 - coupled channels 175
 - coupled states 175
 - energy sudden (ES) 176
 - infinite order sudden (IOS) 176
 - sudden approximations 91,175
- Detailed balance 12,49,126,140,301
- Detection sensitivity 252
- Dipole moment function 236
- Direct collision dynamics 114
- Dissociation 2,9,21,22,31,65,66,308
- Dissociative attachment process under nonequilibrium conditions 31,236
- Dissociative electron attachment 191
 - to carbon monoxide 220
 - to hydrogen chloride 225
 - to molecular hydrogen 209
 - to molecular nitrogen 217
- Double resonance 238

- Electron energy distribution function 315
- Electron entry amplitude 198
- Electron temperature T_e 316
- Electron-beam switches 227
- Electronically nonadiabatic relaxation 121
- Energy randomization 128

- Experimental rate constants for vibrational energy transfer 259,260, 261,264
- F + H₂ 164
- Fermi resonance 120
- First-order perturbation theory 117
- Gaseous dielectrics 228
- H + HX (X = F, Cl) systems 139
- H₂ 61
- H₂ rotovibrational populations 255
- H₃ system 137,161,163
- Halogen and interhalogen molecules 169
- HCl, HF chemical lasers 238
- Hierarchy of relaxation times 8,22
- "Hot" H,D atoms 141,148,151
- Hydrogen bonding 119
- Hydrogen dissociation in electrical discharges 29
- Hydrogen halide 242
- Hyperspherical adiabatic approach 177
- Inelastic processes in CO 318
- Inelastic processes in molecular nitrogen 324
- Infrared chemiluminescence 126,146,235
- Infrared fluorescence experiments 139, 154,247
- Infrared spontaneous emission 235,242
- Infrared-infrared double resonance 264
- Inhomogeneous media 239
- Intramolecular V-V energy transfer 120,128
- Inverse isotope effect 277
- Ions on diatomic molecules 172
- Isotope effect for dissociative attachment and vibrational excitation 212
- Isotope exchange 124,143,149,153
- Isotope separation by V-V pumping 271
- Isotopic enrichment 240
- Isotopic enrichment chemistry 275
- Jacobi vectors 174
- Laser-induced fluorescence 136,152, 154,261
- Laser-induced vibrational kinetics 6, 8,14,16,70,278
- Laser oscillation ranges 244
- Laser plasma instabilities 228
- Level shift 197
- Level width 197
- Light-scattering techniques 245
- Magnetic multicusp plasma generator 255
- Maximum free energy 130
- Mixture of ¹²C¹⁶O and ¹³C¹⁶O 272
- Mode-selective chemistry 128
- Molecular lasers 238
- Multipass optical device 239
- Multiphoton absorption 248
- Multiphoton ionization 259
- Multipole-multipole interaction 89
- ¹⁴_N¹⁴_N and ¹⁴_N¹⁵_N 272
- Neutral beam injection in fusion plasma 227
- Nitrogen dissociation in electrical discharges 22
- Nitrogen ionization 24
- Nitrogen/oxygen mixtures 286
- Non-steady-state relaxation 63
- Nonadiabatic transitions 114,135,136, 142,145
- Nonlinear optical susceptibility 250
- O + H₂ 165
- Opto-galvanic spectroscopy 259
- Phase-space calculations 131
- Polar dissociation 203
- Polyatomic molecules 305,307
- Post-discharge conditions 40,324
- Probe laser 236,239

Quenching of the infrared spontaneous emission 260

Radical recombination 128,153

Radical-radical collisions 132

Rapp-Englander-Golden theory (REG) 86

Rate coefficients 321

Relaxation as the result of chemical interaction 124

Relaxation times 6,7,19,21,51,52,317,319,322

Resonance model 191,192

- boomerang limit 195
- capture radius 193
- compound state limit 195
- impulse limit 195
- lifetime of the resonant state 193
- local complex potential model 194
- monolocal complex potential 194
- stabilization radius 193
- type I, II resonances 194
- width of the resonance 193

Resonances

- in carbon monoxide 218
- in hydrogen chloride 222
- in molecular hydrogen 207
- in molecular nitrogen 212

Resonant contribution to the cross section for vibrational excitation 201

Resonant dissociation by electron impact 217

Rigid rotator 93

Rotational temperature 235,237

RRKM theory 129

Saturated fluorescence 248

Scaling relations 88,91,99

Second-kind collisions 315

Semiclassical approach 94,123,124,132,139,143,147

Sharma-Brau theory (SB) 86

Shock tubes 135,150,152

Single-temperature approximation 310

Skewing angle 178

Spatial resolution 245,253

Species with closed electronic shells 116

Spectral analysis 251

Spontaneous Raman scattering 245

State-to-state data 115,133

Statistical adiabatic channel model 130

Stimulated Raman effect 18,19,20

Superelastic collisions 315

Surface hopping 123

Time-resolved fluorescence 243

Time-resolved measurements 261

Transition state theory 123,129

Translational energy conservation equation 10,273

Translational temperature (T_g) 5

Treanor distribution 5,11,52,53,240,304

Treanor minimum 11,50,53,304

Tunable infrared lasers 238

Two-quanta V-V transitions 37,50,59,85,265

Unsaturated molecules 147

Velocity-modulated infrared laser spectroscopy 259

Vibration to electronic energy exchanges 2,39,144

Vibrational deactivation on the walls 27,29

Vibrational distributions 22,51,77,233

Vibrational master equations 9,10,20,48,49,65,273

Vibrational temperature 5,289,316

V-T (vibration-translation) energy exchanges 2,49,54,88,97,116,120

V-T relaxation of polyatomic molecules 296

V-V and V-T fluxes of vibrational quanta 56,57,63,76,302

V-V and V-T rates 97

Ar + CO₂ 102
CO + CO 98,100,101,102,107
CO + H₂ 102
CO + N₂ 100,102
DF + DF 102
H + H₂ 163
H₂ + H₂ 102,103
He + CO 98,100,102,106
⁴He + HD 102
⁴He + H₂ 102
⁴He + H₂O 102
HF + DF 102
HF + HF 102
N₂ + CO₂ 102
N₂ + N₂ 102,104
Ne + CO₂ 102
Vibrational adiabaticity 130

Vibrational distribution for polyatomic molecules 301

Vibrational excitation and reactions of polyatomic molecules 305,307

Vibrational excitation by electron impact 191

Vibrational excitation

of carbon monoxide 219

of molecular nitrogen 215

Vibrationally adiabatic transition state theory 124

Virtual states 223

V-V energy exchange of highly polyatomic molecules 299

V-V (vibration-vibration) energy exchanges 2,5,49,54,89,97,119,127

V-V' energy transfer 44,78

X, Y + HX (X = F, Cl, Br; Y = Cl, Br, O) 141,166

- 1 **Beam-Foil Spectroscopy**
Editor: S. Bashkin
 - 2 **Modern Three-Hadron Physics**
Editor: A. W. Thomas
 - 3 **Dynamics of Solids and Liquids by Neutron Scattering**
Editors: S. W. Lovesey and T. Springer
 - 4 **Electron Spectroscopy for Surface Analysis** Editor: H. Ibach
 - 5 **Structure and Collisions of Ions and Atoms** Editor: I. A. Sellin
 - 6 **Neutron Diffraction** Editor: H. Dachs
 - 7 **Monte Carlo Methods** in Statistical Physics Editor: K. Binder 2nd Edition
 - 8 **Ocean Acoustics** Editor: J. A. DeSanto
 - 9 **Inverse Source Problems** in Optics
Editor: H. P. Baltes
 - 10 **Synchrotron Radiation**
Techniques and Applications
Editor: C. Kunz
 - 11 **Raman Spectroscopy** of Gases and Liquids Editor: A. Weber
 - 12 **Positrons in Solids**
Editor: P. Hautojärvi
 - 13 **Computer Processing of Electron Microscope Images**
Editor: P. W. Hawkes
 - 14 **Excitons** Editor: K. Cho
 - 15 **Physics of Superionic Conductors**
Editor: M. B. Salamon
 - 16 **Aerosol Microphysics I**
Particle Interaction
Editor: W. H. Marlow
 - 17 **Solitons**
Editors: R. K. Bullough and P. Caudrey
 - 18 **Magnetic Electron Lenses**
Editor: P. W. Hawkes
 - 19 **Theory of Chemisorption**
Editor: J. R. Smith
 - 20 **Inverse Scattering Problems** in Optics
Editor: H. P. Baltes
 - 21 **Coherent Nonlinear Optics**
Recent Advances
Editors: M. S. Feld and V. S. Letokhov
 - 22 **Electromagnetic Theory of Gratings**
Editor: R. Petit
 - 23 **Structural Phase Transitions I**
Editors: K. A. Müller and H. Thomas
 - 24 **Amorphous Solids** Low-Temperature Properties Editor: W. A. Phillips
 - 25 **Mössbauer Spectroscopy II**
The Exotic Side of the Method
Editor: U. Gonser
 - 26 **Crystal Cohesion and Conformational Energies** Editor: R. M. Metzger
 - 27 **Dissipative Systems in Quantum Optics** Resonance Fluorescence, Optical Bistability, Superfluorescence
Editor: R. Bonifacio
 - 28 **The Stratospheric Aerosol Layer**
Editor: R. C. Whitten
 - 29 **Aerosol Microphysics II**
Chemical Physics of Microparticles
Editor: W. H. Marlow
 - 30 **Real-Space Renormalization**
Editors: T. W. Burkhardt and J. M. J. van Leeuwen
 - 31 **Hyperfine Interactions of Radioactive Nuclei** Editor: J. Christiansen
 - 32 **Superconductivity in Ternary Compounds I** Structural, Electronic, and Lattice Properties
Editors: Ø. Fischer and M. B. Maple
 - 33 **Molecular Collision Dynamics**
Editor: J. M. Bowman
 - 34 **Superconductivity in Ternary Compounds II**
Superconductivity and Magnetism
Editors: M. B. Maple and Ø. Fischer
 - 35 **Multiple-Photon Excitation and Dissociation of Polyatomic Molecules** Editor: C. D. Cantrell
 - 36 **Applications of the Monte Carlo Method** in Statistical Physics Editor: K. Binder 2nd Edition (in preparation)
 - 37 **Thin Film and Depth Profile Analysis**
Editor: H. Oechsner
 - 38 **Coherent Radiation Sources**
Editors: A. W. Sáenz and H. Überall
-